Department of Computer Science

ITCS 447 / ITCS 393 Java Programming

Mid Term Exam

I - Semester 2014-2015

	MARKS	
1	30	
2	30	
Total	60	

ID #	
NAME	
SECTION	1

Max. Marks: 60
Time: 1 hr 30 minutes

Q (1) It is required to develop a class called **`Set`** to represent a set as an array and implement various set operations. Assume that the elements of the set are integers.

This class will have the following instance variables: (a) an array called **`list`** of type **int**, (b) **size**: the capacity of the array **`list`**, and (c) **`length`**: the number of elements in the **`list`**.

This class will have the following methods:

(1) Constructor without any parameter (default constructor), which uses a default value of 10 as **`size`**, creates array **`list`** of capacity equal to **`size`** and initializes **`length`** to 0.

(2) Constructor with parameter **`aSize`** for **`size`**. Initialize size to **`aSize`**, create array **`list`** of capacity equal to **`size`** and initialize **`length`** to 0.

(3) Instance method **`getLength`**, which returns **`length`**.

(4) Instance method **`isEmpty`** to determine whether the set is empty or not.

(5) Instance method **`isMember`** that accepts a parameter **`element`** of type **`int`**. If **`element`** exists in the **`list`**, it will return true, else it will return false.

(6) Instance method **`isEqual`** that accepts a parameter **`aSet`** of type **`Set`**. The method will return true, if **`aSet`** is equal to "this object", else it will return false. Two sets are equal, if they contain same elements in any order.
Ex: Let A and B be two sets;
A = {10, 4, 20, 15, 12}, B = {4, 10, 12, 15, 20}. As sets A and B contain same elements, but in different order, therefore, they are equal.

(7) Instance method **`union`** having a parameter **`aSet`** of type **`Set`**. The method finds the union of **`aSet`** with "this object" and returns the result.
Ex: Let A = {10, 4, 20, 15, 12, 18}, B = {8, 10, 25, 15, 20},
$A \cup B$ = {10, 4, 20, 15, 12, 18, 8, 25}.

(8) Class method **union** having two parameters **aSet and bSet** of type **Set**. The method finds the union of **aSet** with **bSet** and returns the result.

(9) Instance method **intersection** having a parameter **aSet** of type **Set**. The method finds the intersection of **aSet** with "this object" and returns the result.

Ex: Let A = {10, 4, 20, 15, 12, 18}, B = {8, 10, 25, 15, 20},

$A \cap B$ = {10, 20, 15}

(10) Class method **intersection** having two parameters **aSet and bSet** of type **Set**. The method finds the intersection of **aSet** with **bSet** and returns the result.

Q(2) Write a GUI based application to calculate the area of a triangle. The area of a triangle can be calculated, if we know two sides of a triangle and the angle between them as follows:

Area = ½ a b sin θ

Where, a = side 1 of the triangle (data type – double)

b = side 2 of the triangle (data type – double)

θ = angle between side 1 and side 2 (data type – double).

The user can specify the angle θ in degrees or radians. But, the trigonometric functions in class Math of Java requires angle in radians.

Create labels **Side1** and **Side2**, each one followed by a text field, to enter the value of each side. Create radio buttons **Degrees** and **Radians**, for the user to select the way the user wants to enter the angle. Create a label **Angle** followed by a text field for the user to enter the angle θ. Also, create a label **Area**, followed by a text field to display the result.

Create buttons **Compute** and **Clear**. When the user clicks on **Compute** button, the area of the triangle is calculated and the result is displayed in the text field corresponding to **Area**. Assume that the default values of **Side1** and **Side2** are 1.0 and for angle is 30°. When the user clicks on **Clear** button, text fields corresponding to **Side1, Side2, Angle** and **Area** will be cleared.